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THE WAR FIGHTER'S COMMAND AND CONTROL  
READING LIST

by

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## *Contents*

Page	
DISCLAIMER .....	ii
LIST OF ILLUSTRATIONS .....	v
LIST OF TABLES .....	vi
PREFACE .....	vii
ABSTRACT .....	viii
INTRODUCTION.....	1
Statement of the Research Question .....	2
Scope and Limitations.....	3
Reading List Methodology.....	4
COMMAND AND CONTROL DEFINITIONS .....	5
The Command Function .....	7
The Command and Control Process .....	8
Command and Control Systems.....	9
Summary .....	10
C2 MODELS.....	12
The OODA Loop .....	12
The Lawson-Moose Cycle .....	14
Summary .....	16
C2 CONSIDERATIONS.....	18
C2 and Organizational Decisions.....	18
C2 and Culture .....	20
Interoperability and Joint C2 Systems .....	24
A Cautionary C2 Tale .....	25
Summary .....	26
C2 IN ACTION.....	28
C2 Evolution .....	28
The Reward .....	30
Summary .....	31

CONCLUSIONS .....	33
APPENDIX A: FINDING THE RECOMMENDED READINGS .....	35
BIBLIOGRAPHY .....	36

## *Illustrations*

	<i>Page</i>
Figure 1. C <sup>1</sup> Catharsis.....	7
Figure 2. The OODA Loop .....	13
Figure 3. Lawson-Moose Cycle .....	14
Figure 4. Impact of “Coalition” on Command and Control.....	23

## *Tables*

	<i>Page</i>
Table 1. Summary of Recommended C2 Readings .....	34

## *Preface*

The idea for this paper came as a result of my studies in the Joint C4I Systems curriculum at the Naval Postgraduate School (NPS). In an attempt to encapsulate what I had learned at NPS, I began scratching out a list of key command and control books and articles. Members of the C4I-Pro Internet mailing list reviewed my initial list and I would like to acknowledge all the suggestions I received from the fine individuals on the list. In particular, I would like to thank RADM Jerry Holland, USN, Retired, of the Armed Forces Communications and Electronics Association (AFCEA) for his excellent advice and recommendations. I would also like to thank my faculty research advisor, Lt Col Raul Meza, for his comments and for helping me keep on track. Finally, any research effort cannot come to fruition without the support of ones' family. I am thankful for their understanding and patience while "Daddy was working in the den."



### ***Abstract***

In today's military, few concepts are more overlooked than command and control. While a crucial topic, it is not always easily understood and many avoid it completely. But given the importance of this war fighting discipline, how does an officer interested in command and control know where to devote his or her time to develop an understanding of the subject? Without some kind of "roadmap," exploration would at best be a hit or miss affair. This paper provides such a "roadmap" to explain key command and control concepts and recommends the seminal readings that best exemplify these concepts.

Among these concepts is how command and control *systems* implement command and control *processes* that enable the command and control *function*. Then the paper explains two theoretical models that show the interactions between command and control elements. Next, it presents command and control implementation considerations. These include challenges of culture, organizational design, interoperability, and the dangers of micro-management. Finally, tracing command styles and looking at the battle of Gettysburg highlight the art of command and control in action.

Most importantly, this paper identifies the seminal texts that a senior company grade or field grade military officer should read to "get smart" on command and control. Incorporated into a personal reading program, these books provide a guide for a professional reading journey that give a war fighter an excellent start to understanding the art and science of command and control.

## Chapter 1

### Introduction

*One of the least controversial things that can be said about command and control is that it is controversial, poorly understood, and subject to wildly different interpretations.*

—Colonel Kenneth Moll, USAF  
*Understanding Command and Control*

Few will argue that command and control activities have been a vital part of military campaigns. From Alexander the Great's shouted battlefield commands during his conquest of Persia, to the beginnings of "information age warfare" as displayed in DESERT STORM, command and control has clearly been a key war fighting discipline. Those who have mastered the techniques and application of effective command and control have often, all other things being equal or even less than equal, prevailed in combat.

The importance of command and control (broadly defined) has long been recognized. Sun Tzu explicitly discusses the control of armies through formations and signals.<sup>1</sup> Likewise, Clausewitz' chapters on the use of intelligence in war and the problems of "fog and friction" highlight additional challenges for the command and control practitioner.<sup>2</sup> However, it is not just the "dead theorists" who recognize the importance of command and control. The Department of Defense's current long-range vision statement, *Joint Vision 2010*, says, "Throughout history, gathering, exploiting, and

protecting information have been critical in command, control, and intelligence. The unqualified importance of information will not change in 2010.”<sup>3</sup> Joint Vision 2010 places great faith in having “information superiority,” which is underpinned by effective command and control, as the key enabler of the operational concepts of dominant maneuver, precision engagement, focused logistics and full-dimensional protection.<sup>4</sup> So in an age of warfare defined by increasing use of advanced communications, satellites, and computers, command and control is a vital area of war fighting competence. Given this importance, it is imperative for military war fighters to understand both the art and science of command and control as part of a well-rounded professional military education.

### **Statement of the Research Question**

As the information revolution has taken hold over the last thirty years, the topic of command and control has been extensively written about. These writings have greatly expanded the theoretical command and control body of knowledge. There is also a much larger set of writings that explores the technical issues related to command and control. Reams have been written about particular systems, methods of communication, types of software, employment tactics, and measures of effectiveness. With this imposing selection of potential reading material, how does a military officer interested in command and control know where to devote his or her time in order to develop a basic understanding of the subject? Without some kind of “roadmap,” exploration of such an important subject would at best be a hit or miss affair. This paper seeks to remedy this problem by providing just such a “roadmap” that recommends the readings that best exemplify key command and control concepts. With such a “roadmap,” a senior company

grade or field grade officer can explore the command and control basics in a focused manner without being overwhelmed. These readings are meant to be part of a personal reading program and do not substitute for coverage of command and control topics contained in professional military education courses.

## **Scope and Limitations**

Selecting a “best of” reading list is by nature a subjective undertaking. Thus articles or books chosen were done so based on answers to several screening questions. First and foremost, does the source explain one or more key command and control concepts? Second, are the explanations given in such a way as to be intelligible to the average military reader? Overly technical readings or ones requiring specialized education were therefore not included. Third, how available is the particular source to the larger military community? If a source is too hard to obtain, it is not likely to be read.

The scope of documents used was also limited to those dealing with operational-level command and control theories and concepts. Coverage of tactical-level material or technical details on specific systems, communications links or computers will not be included. This paper is also not about “how to command.” That subject is much broader and has been covered very well by many others. In addition, with one exception, official Joint and Service command and control doctrine publications were not included. While such publications are doubtless important reading, other documents give a better overall view of the subject. Finally, in the interests of brevity, the entire list of recommended command and control readings was capped at eight sources. This self-imposed limit forces the readings to remain focused and enables the military officer to finish the reading list in a reasonable amount of time.

## Reading List Methodology

A readings-based approach to studying command and control is not a new idea. Frank M. Snyder of the National Defense University took such an approach in his excellent text called *Command and Control, The Literature and Commentaries*. While Snyder took a much more broad and extensive look into the subject, his idea of tying key concepts to particular readings is one this paper has chosen to emulate. Each recommended reading will be introduced by a section that explains the key command and control concept that it exemplifies. Then the reading will be briefly summarized and the vital passages highlighted as an aid to the reader. In essence, this paper will serve as a “roadmap” to an examination of command and control. While it will give the reader a decent idea of the “sights,” it does not replace going to the source and perusing the reading in its totality. Organizationally, this “roadmap” starts with a chapter on command and control definitions, followed by a chapter on command and control theoretical models. A chapter is then devoted to essential considerations for the command and control field. The last main chapter discusses command and control “in action,” while the concluding chapter summarizes the recommended reading list.

### Notes

<sup>1</sup> Sun Tzu, *The Art of War* (Oxford: Clarendon Press, 1963), 90.

<sup>2</sup> Carl von Clausewitz, *On War* (Princeton, NJ: Princeton University Press, 1976), 117-121.

<sup>3</sup> *Joint Vision 2010* (Washington, DC: Chairman of the Joint Chiefs of Staff), 16.

<sup>4</sup> *Ibid.*, 19.

## Chapter 2

### Command and Control Definitions

*The beginning of wisdom is calling things by their right names.*

—Confucius  
*Analects*

The generic terms command and control—or some derivation thereof—are at least somewhat familiar to most military members. Unfortunately, that is about the limit of our shared understanding. Part of the problem is the proliferation of confusing terms related to this area. Greg Todd made light of this confusion in the ditty shown in Figure 1. Written firmly tongue in cheek, the basic truth is undeniable. While over twelve years have passed since Mr. Todd wrote this piece, the only real progress seems to have been the addition of C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) to the panoply of terms. This is not to say term proliferation happened without reason. For example, the addition of “communications” was to emphasize the dependence of command and control on good communications. The term “computers” was added for much the same reason.

However, the profusion of terms does tend to obscure the basic nature of command and control. Thus if you wish to have meaningful discussion on a particular issue, it is vital to have common terms of reference. Such terms provide a way to converse using shared concepts, and without such terms mutual understanding about command and

control will be difficult. Therefore, in an attempt to frame discussion of essential concepts, the first step is to put forward some simple, logical and coherent definitions for the various aspects of command and control. As a primarily military concern, an obvious place to start is with the joint doctrinal definition for “Command and Control” listed in the *Department of Defense (DOD) Dictionary of Military and Associated Terms*:<sup>1</sup>

The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities and procedures which are employed by a commander in planning, directing, coordinating and controlling forces and operations in the accomplishment of the mission.

Once upon a time, everybody understood what military commanders did. They commanded. This was simple enough and sufficient for a thousand years and more. In the complexity of the late twentieth century, however, it was insufficient. Whatever its virtue in brevity and clarity, the concept was wanting in prestige.

So suitable steps were taken. Henceforth, commanders would no longer command. Commanders would *exercise* command. This would be much better.

Still, somehow, that was not enough. Then it happened, an event as significant as the splitting of the atom, perhaps in a think tank as dawn broke over the Washington, D.C., Beltway.

If one direct object was good, two would be better. If atoms could be split, so could the act of command.

Now, commanders would exercise command and *control*. Eureka! Never mind that command already implied control. Never mind that without control one could not command.

As split atoms tend toward a grander effect, however, so did this particular linguistic miracle continue to mushroom. Command and control became command, control and communications.

Never mind that without communications one could not ... well, never mind.

A rather bizarre but important development then took place. The instigator, perhaps a well-schooled social scientist, strategist or alchemist, took into this hands “command, control and communications” and transformed, compressed and recreated it in his own technocratic image: C<sup>3</sup>.

Somewhere, the lid to Pandora’s box was raised. Soon, command and control degenerated to C<sup>2</sup>. Command, presumably, became C<sup>1</sup>.

Then there was C<sup>3</sup>I: command, control, communications and intelligence.

Then there was C<sup>4</sup>: command, control, communications and computers. Honest.

Then, C<sup>5</sup>: command, control, communications, computers and cohesion.

Then, C<sup>6</sup>: command, control, communications, computers, cohesion and counterintelligence.

Days passed. What had been created, evolved ...

C<sup>27</sup>E: command, control, communications, computers, cohesion, counterintelligence, cryptanalysis, conformance, collaboration, conceptualization, correspondence, camaraderie, commissaries, camouflage, calculators, cannon, caissons, canteens, canoes, catapults, carpetbaggers, caddies, carabineers, carrier pigeons, corn whiskey, camp followers, calamine lotion, etc.

This, then, is the C<sup>27</sup>E system.

Never mind simple command. Never mind the tools of command. Never mind, even, the idea of a chain of command. All that is needed is the C<sup>2</sup>/E system. It has something to do, I am told, with the relationship between commanders and soldiers, between leader and led.

### **Figure 1. C<sup>1</sup> Catharsis (From Greg Todd, *Army*, February 1986)**

The first key to this definition is that it is about a commander exercising authority—or what is called the “command function.” Note there are command and control activities occurring that together can be named the “command and control process.” Finally, there are procedures and items—equipment, people, and facilities—that support the overall function and process. Collectively, these are “command and control systems.”<sup>2</sup>

### **The Command Function**

At the root of this entire area is the idea of “command” as a military function. Due to military requirements for clear responsibility and unity of effort, the command function is given to specific individuals in a formal chain of command. These individuals are charged with battlefield leadership and “combat direction.”<sup>3</sup> That is, they are responsible for *deciding* what must be done on the battlefield and for ensuring their decisions are properly *executed*.<sup>4</sup> This is the essence of the command function.

While the official definition clearly captures the importance of the command function, what about the term “control?” What is the distinction between it and command? Since this is not clearly stated, it is worth examining how control fits into the picture. Control can be likened to the command task of executing in that it is concerned with the implementation and monitoring of a decision already made by a commander. Thus people other than the commander can perform the control function. In fact, one of the main purposes of a commander’s staff is to perform this function by directing and monitoring activities that are congruent with the commander’s overall intent.



Additionally, control embodies the idea that the command function is not just a downward directed activity. Information on friendly force readiness, position, and progress all flow back to the commander via multiple feedback loops. This allows the commander to make adjustments and modifications to his or her direction based on current information.<sup>5</sup>

The command function then is the basis from which to proceed. Encompassing both formal command as well as the notion of control, it is the fundamental war fighting function that anything else related to command and control must support. For the sake of brevity, these two terms are abbreviated as “C2” and will be used to denote the overall field as well as the basic war fighting function. Frank M. Snyder, in *Command and Control, The Literature and Commentaries*, gives concise treatment on this entire subject. Developed as a text for a National Defense University (NDU) command and control course, Chapter One, “Command and War” is specifically recommended.

## **The Command and Control Process**

Given a war fighting C2 function, the official DOD definition goes on to talk about the “procedures employed by a commander” in executing this function.<sup>6</sup> These procedures can be called the “C2 Process.”<sup>7</sup> It includes the specific approaches (not technologies) a commander uses to learn, decide, organize, communicate and monitor. There are many ways to set up a given C2 Process and several factors must be considered. First, how near will the commander be to the battle?<sup>8</sup> If the commander needs to be in close in order to keep control, then the C2 Process must support this. A commander must also decide on the type and organization of the military staff.<sup>9</sup> What reports will be required and how will intelligence/information be gathered, fused and

disseminated? Likewise, a commander must understand where he or she fits into the overall scheme by understanding what authority the commander possesses for tactical, operational and strategic decisions. Originally, a commander such as Alexander the Great held responsibility as the sovereign and as the general. While this situation has changed, authority level will still greatly influence the C2 Process.<sup>10</sup> If a commander has tactical responsibility, C2 procedures must enable battlefield control and movement of forces.<sup>11</sup> As an example, the movement of troops via marching commands is one way to address this need. On a modern note, airspace control and deconfliction is a prime example of battlefield C2 procedures. Finally, a commander must understand the speed with which information can or should flow during a war.<sup>12</sup> Dispatches that used to take hours or days can now take minutes or seconds. If a C2 Process can't handle a swift data flow, it leaves the commander vulnerable to a nimble foe who is able to operate within his C2 cycle.<sup>13</sup>

The book *Command in War* by Martin Van Creveld provides the definitive text on the C2 Process evolution. It traces from the “stone age” of command through general staff development, the “directed telescope” concept, early communications technology, maneuver warfare, and modern computers. Of particular interest are Chapter Two, “The Stone Age of Command,” and Chapter Eight, “Conclusion: Reflections on Command.”

## **Command and Control Systems**

Looking back once again to the official C2 definition, we see a reference to command and control systems. These “C2 Systems” are the collections of people and physical things that make up the “information exchange and decision support subsystems”<sup>14</sup> used to implement the C2 Process in support of the C2 Function. Interestingly, most of the emphasis in the C2 world is put on the tangible tools such

computers, software, transmission lines, switches, and terminals. The reason for this emphasis is probably because C2 Systems fall more into the “science” of C2 as opposed to the more fuzzy (and therefore less objective) “art” of C2.

Making these collections of people and tools work (and work together) is a challenge that involves development and acquisition of cutting-edge technology, systems architecting, and integration into an interoperable whole. Again, Frank M. Snyder in *Command and Control, The Literature and Commentaries*, gives excellent treatment in this area. Of specific interest, C2 Systems are explored in Chapter Seven, “C4 Systems for Conventional Forces/Interoperability” and Chapter Nine, “C4 System Architecture.”

## Summary

The terms presented above are not new. Based firmly on the agreed DOD definition, they clearly break the overall field into three sections. There is a Command (and Control) Function implemented via a C2 Process and supported by various C2 Systems. Other more precise but confusing terms will be eschewed in favor of these three. These terms, taken with the models discussed in Chapter Three, are sufficient to explore the C2 field.

## Notes

<sup>1</sup> Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 12 January 1998, 84.

<sup>2</sup> Frank M. Snyder, *Command and Control—The Literature and Commentaries* (Washington, DC: National Defense University Press, September 1993), 10.

<sup>3</sup> CAPT Wayne P. Hughes Jr., USN, Retired, “Command and Control within the Framework of a Theory of Combat” (Monterey, CA: Naval Postgraduate School, May 1989), 5.

<sup>4</sup> *Ibid.*, 7.

<sup>5</sup> Snyder, *Command and Control—The Literature and Commentaries*, 12.

<sup>6</sup> Joint Publication 1-02, 84.

<sup>7</sup> Snyder, *Command and Control—The Literature and Commentaries*, 11.

<sup>8</sup> Martin L. Van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1985), 17.

## Notes

<sup>9</sup> Ibid., 28.

<sup>10</sup> Ibid., 39.

<sup>11</sup> Ibid., 46.

<sup>12</sup> Ibid., 20.

<sup>13</sup> John R. Boyd, “Organic Design for Command and Control,” May 1987, 7.

<sup>14</sup> Joint Publication 6-0, *Doctrine for C4 Systems Support to Joint Operations*, 30 May 1995, I-3.

## Chapter 3

### C2 Models

*Often the emphasis in the study of C2 is on either the hardware or the organization of humans and hardware into a system. At other times C2 is studied as the processes carried out over time but without regard for the tactical context or mission of the commander.*

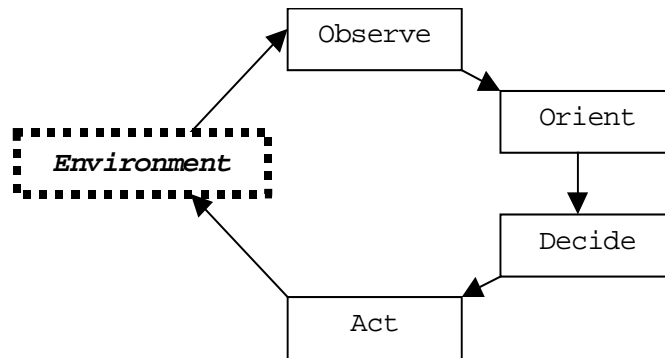
—CAPT Wayne P. Hughes, Jr., USN. Retired  
*Command and Control Within the Framework of a Theory of Combat*

While the C2 definitions provide the boundaries of C2, they do not help much in explaining the activities inherent in the C2 domain. However, as with many subject areas, theoretical models can provide a framework upon which to organize a given body of knowledge. Models promote understanding of hidden connections between activities and often give the constructs required for common understanding. Therefore, without being esoteric, this chapter will discuss two representative C2 models as a way to better understand the C2 field. The first model is the straightforward Observe-Orient-Decide-Act Loop, better known simply as the OODA Loop.<sup>1</sup> The second model is known variously as the Lawson Cycle<sup>2</sup> or the Lawson-Moose<sup>3</sup> Cycle.

#### The OODA Loop

Col John Boyd, USAF, Retired, developed the OODA Loop (Figure 2) based largely on his experiences as a Korean War fighter pilot.<sup>4</sup> From this dogfighting perspective, a fighter pilot must *observe* what is happening, *orient* what he sees with what he already

knows and what he wants, *decide* what must be done and then *act* to implement his decision. Once the action has been taken, the loop begins again. Boyd’s argument is that whoever operates his own OODA Loop faster and better than his adversary will likely win by causing the enemy to fold “back inside himself so that he cannot cope with events/efforts as they unfold.”<sup>5</sup>



**Figure 2. The OODA Loop (From Kenneth C. Allard, *Command, Control and the Common Defense* [New Haven, CT: Yale University Press, 1990], 154.)**

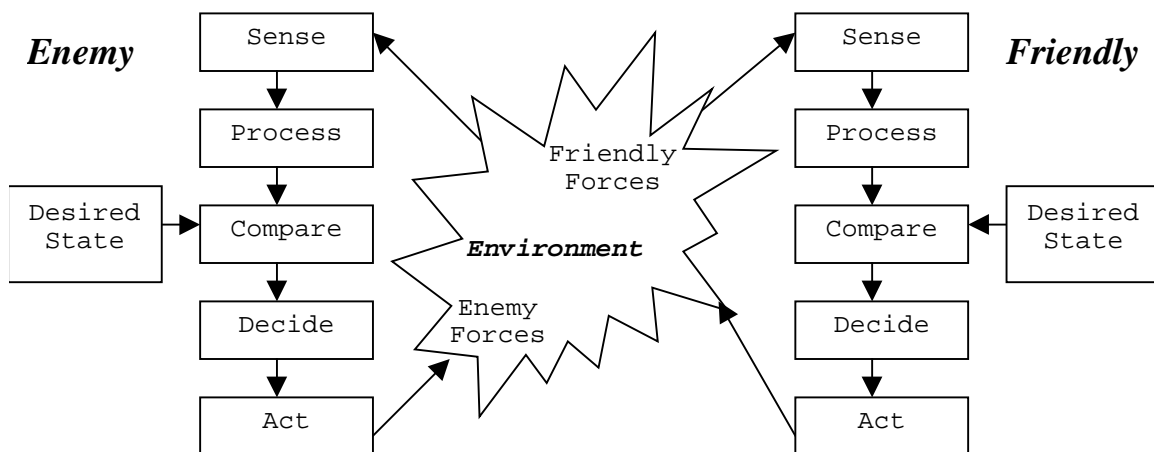
This model is quite well known within the military and “operate within the enemy’s decision cycle” has become a common phrase and operational objective.<sup>6</sup> But while this model has clear implications for tactical war fighting, it is also a good starting point for a C2 model. As Colonel Boyd wrote:<sup>7</sup>

The process of observation-orientation-decision-action represents what takes place during the command and control process—which means that the O-O-D-A loop can be thought of as being the C&C [Command & Control] loop ... Operating inside [the] adversary’s O-O-D-A loop means the same thing as operating inside [the] adversary’s C&C loop.

Since much of the loop takes place within the brain of the human, Boyd called it an “organic” process.<sup>8</sup> But this organic process can also be applied to the interactions of complex organizations such as military forces. Leaders and units at all levels will each have their own particular OODA Loop, all of which will be operating simultaneously at

slightly different rates.<sup>9</sup> Each loop is constrained by the speed of the loops below it and in turn constrains the speed of the loops hierarchically above it. As with the successful fighter pilot, military forces that operate their C2 cycle faster and more effectively will have a clear advantage.

While the simplicity of the OODA Loop carries great intuitive appeal, using these four blocks to explain all of the C2 activities occurring within a large organization requires “substantial expansion and clarification of the process blocks.”<sup>10</sup> Because of this, several other more detailed models have been developed to provide greater clarity and precision. One of these more explicit C2 models is the Lawson-Moose Cycle.



**Figure 3. Lawson-Moose Cycle (From CAPT Wayne P. Hughes Jr., USN, Retired, *Fleet Tactics* [Annapolis, MD: Naval Institute Press, 1986], 187.)**

### **The Lawson-Moose Cycle**

The Lawson-Moose Cycle (see Figure 3) begins with the notion that “the purpose of the command and control process is to either maintain or change the surrounding environment.”<sup>11</sup> Thus, it introduces several items that make this purpose more explicit. First and most obviously, it shows that there is a matching cycle being executed by the

enemy. This illustrates Clausewitz' point that war is a "duel on a larger scale"<sup>12</sup> and that any C2 actions must be conducted realizing the enemy is also acting to change the environment.

Second, the OODA Loop's "observe" block is expanded into "sense" and "process" steps. These more discrete steps become useful as the C2 process moves away from something that happens within a single brain, to a more distributed process that encompasses multiple sensors that produce data that must be turned into actionable knowledge. It is also important to note that there are two general ways to execute the "sense" and "process" steps. First is via the traditional intelligence process. This is the reason the terms "intelligence, surveillance, reconnaissance" are often appended to "command and control." The alternate way is through the "scouting"<sup>13</sup> done directly by combat forces as one of their war fighting functions. "Scouts" gather information and provide it in a less formal manner without much intermediate "processing" since much of the interpretation is often left to the decision maker.

The third explicit addition is a "desired state" input that represents the overall objective of the process. The "desired state" block can include such items as the commander's intent, essential tasks, the mission statement, or the operations order.<sup>14</sup> Using this yardstick, the "compare" step (similar to the OODA Loop's "orient" block) examines the current state of the environment against the desired end state.<sup>15</sup> This enables the commander to "decide" on the appropriate courses of action that he believes will change the environment to his advantage. Once the decision is communicated, the "act" step occurs as friendly forces execute their tasks, some change is made to the environment, and the entire cycle starts again.



## Summary

Both the OODA Loop and the Lawson-Moose Cycle provide ways to categorize C2 activities and systems. However, it is important to note that both of these models can be thought of as “combat” models instead of simply C2 models. For example, the “act” step includes the actual combat maneuver and fighting directed by the commander. The formal intelligence process and its associated sources and production methods also fit nicely into the “sense” and “process” steps. The same is true of scouting done by combat forces. As Hughes notes, “scouting is no more C2 than is shooting.”<sup>16</sup> Thus, he argues the focus of C2 should be more on the “compare” and “decide” blocks and the linkages between all the blocks of the process.

These models provide coherent conceptual frameworks for further exploration of command and control. Excellent explanations of both models are covered by Kenneth Allard in his book titled *Command, Control, and the Common Defense*. This book is on the Chairman of the Joint Chiefs of Staff’s professional reading list and the entire text is outstanding. The recommended readings on C2 models can be found in Chapter Six, “Tactical Command and Control of American Armed Forces,” on pages 153-160.

## Notes

<sup>1</sup> Boyd, “Organic Design for Command and Control,” 26.

<sup>2</sup> Kenneth C. Allard, *Command, Control and the Common Defense* (New Haven, CT: Yale University Press, 1990), 155.

<sup>3</sup> Hughes, “Command and Control within the Framework of a Theory of Combat,” 9.

<sup>4</sup> Allard, *Command, Control and the Common Defense*, 154.

<sup>5</sup> Boyd, “Organic Design for Command and Control,” 2.

<sup>6</sup> Allard, *Command, Control and the Common Defense*, 153.

<sup>7</sup> Boyd, “Organic Design for Command and Control,” 26.

<sup>8</sup> *Ibid.*, 2.

## Notes

<sup>9</sup> *Marine Corps Doctrinal Publication 6, Command and Control* (Washington DC: Department of the Navy, HQ United States Marine Corps, 1996), 64.

<sup>10</sup> George E. Orr, *Combat Operations C3I: Fundamentals and Interactions* (Maxwell AFB, AL: Air University Press, 1983), 26.

<sup>11</sup> Gregory D. Foster, "Contemporary C2 Theory and Research: the Failed Quest for a Philosophy of Command," *Defense Analysis*, September 1988, 205.

<sup>12</sup> Clausewitz, *On War*, 75.

<sup>13</sup> Hughes, "Command and Control within the Framework of a Theory of Combat," 6.

<sup>14</sup> *Ibid.*, 9.

<sup>15</sup> Thomas P. Coakley, *Command and Control for War and Peace* (Washington, DC: National Defense University Press, 1992), 33.

<sup>16</sup> Hughes, "Command and Control within the Framework of a Theory of Combat," 7.

## Chapter 4

### C2 Considerations

*It turned out to be another scrambled outfit ... with so many lines of responsibility, control, and coordination on the chart that it resembled a can of worms as you looked at it. I made a note to tell Walker to take charge, tear up the chart, and have no one issue orders around there except himself. After he got things operating simply, quickly, and efficiently he could draw up a new chart if he wanted to.*

—George Kenney  
*General Kenney Reports*

When practicing the art and science of C2, several essential items require consideration. First among them is how organizational structure can drive C2 processes and C2 systems design. A second consideration is how culture—both Service and coalition—can impact C2 operations. Third is the challenge of building C2 systems that are joint and interoperable. Finally, application of modern C2 systems allows an unprecedented degree of control and oversight. Applying these modern systems has some inherent pitfalls that must be avoided to preclude micro-management of the battle effort.

### C2 and Organizational Decisions

Sun Tzu says, “order or disorder depends on organization.”<sup>1</sup> So one of the commander’s key tasks is organizing forces to achieve the order needed to accomplish the mission. Organizing includes setting up the structure of a unit, determining who talks to whom, where information must flow, who may make what kinds of decisions, and

what reports are required.<sup>2</sup> Picking the proper organizational structure involves several factors:

1. Should a force be organized by area [region] or by function [combat specialty]?
2. Should units be organized by skill or by task?
3. How should forces from different nations be combined?
4. Should forces be organized by medium (air, land, sea, space)?
5. What span of control (broad or narrow) does the commander desire?
6. Will authority be centralized or decentralized?<sup>3</sup>

Obviously, the answers to these questions will have a strong influence on the type of C2 processes that are appropriate and the kind of C2 systems that are required. In fact, the link between organizational structure and C2 requirements is so tight that “every organizational decision is also a C4 systems decision.”<sup>4</sup>

In particular, the choice between a “centralized, monocentric system of C2 or a very decentralized, polycentric system” will have huge impacts on the C2 approach.<sup>5</sup> This is well-illustrated by how the organizational differences between Services drive the types of command arrangements that they pick, which determines the C2 approaches they feel are most appropriate.<sup>6</sup> For example, the U.S. Army has a large number of autonomous “shooters” that may or may not be in constant communication with higher echelons. Thus the U.S. Army relies on a “problem-solving” approach where at least two echelons lower are given specific objectives they are to accomplish, along with some guidance on how to accomplish those objectives.<sup>7</sup> Within this command arrangement, subordinates are then given a great deal of autonomy and room for innovation, with great stock placed in synchronization of actions. Since this approach is not completely decentralized, this method levies a need for a moderate level of communications between echelons and a high degree of processing capability at the center.<sup>8</sup>

On the other hand, the U.S. Air Force has chosen to use a “cyclic” command arrangement. An arrangement where orders—in particular the Air Tasking Order (ATO)—go out from a single centralized location to all subordinate units once every 24 hours (or perhaps some shorter period). The reason for this is because “the complexity of air operations has meant the information required, coordination needed, and relative scarcity of the assets involved tend to drive the decision making up the chain of command.” Since most of the planning and deciding is done centrally, the amount and frequency of inputs and outputs from that center are high. In addition, the amount of centrally located processing power to handle these inputs and outputs must be large. Anyone who has seen the computers and other C2 gear at an Air Operations Center (AOC) could vouch for these C2 requirements.<sup>9</sup>

From these two examples it is easy to see how different war fighting organizational structures—often based on the peculiarities of a given operating medium—drive the command arrangements and associated C2 system requirements. It is also easy to see how clashes could occur between organizations with different command arrangements based on a unique Service or national culture. David Alberts and Richard Hayes, in their work *Command Arrangements for Peace Operations*, provide an excellent overview of the various C2 styles in Chapter Five, “Alternative Approaches to Command Arrangements.”

## **C2 and Culture**

As stated earlier, one of the main goals of C2 is to promote unity of effort among all elements of a force. Among the barriers to achieving this are the differing Service cultures. Particularly illustrative of this challenge is the case of command and control for air warfare. Given our strong individual Service structure, each Service brings a different

perspective to the conduct and control of air warfare that is based on their unique heritage and doctrine. However, as Kenneth Allard wrote, “The downside to this common heritage of service authority is that it is largely an internal mechanism and so, in a sense, stops at the water’s edge. Precisely because service command structures exert first claim on the loyalty of their members, command relationships between the services have been a persistent problem.”<sup>10</sup> Therefore, the Air Force takes a hard line on centralized control of all airpower by an airman in order to properly prioritize and use scarce theater assets for the overall good. Meanwhile, the Navy and the Marine Corps believe, based on their experiences, that their organic air assets should not be split from the sea environment or from the combined-arms task force of the Marines.<sup>11</sup> These built-in differences lead to a number of issues that must be addressed in order to conduct effective and joint air warfare. These include:

1. What unity of command is required to achieve unity of effort?
2. When is unity of command not essential to effective air operations?
3. When is there no need for a single air component commander to control all air assets?
4. When does Marine air not have to be under the control of a Marine Corps combined-arms commander?
5. When is naval air not needed to protect naval forces or prosecute a naval campaign?
6. When can air units of one service be placed under the control (or even command) of an officer of another service?<sup>12</sup>

James Winnefeld and Dana Johnson examine these issues in detail in their book *Joint Air Operations, Pursuit of Unity in Command and Control, 1942-1991*. This text is on the chief of staff of the Air Force’s professional reading list and Chapter Two, “Doctrine and Experience” and Chapter Nine, “Lessons Learned, Relearned and Unlearned” constitute the most essential parts. Using a historical analysis of air operations from WW II

(Midway, the Solomons), Korea, Vietnam, Operation El Dorado Canyon and Operation DESERT STORM, Winnefeld and Johnson evaluate the effectiveness of joint air command and control. Their conclusion includes a set of recommended guidelines upon which to model future joint air operations. In the end, they are optimistic about the ability of the various air arms to have unity in command and control. Nevertheless, they do include a warning about waiting until the fighting begins before starting to think about unity of air effort.<sup>13</sup>

These airman, from different services and with different capabilities but bound together by mutual respect, can act as their country's shield. The sacrifices and experiences of their predecessors will teach them that unity grows stronger as one moves closer to the sound of guns, and that in the future the country cannot afford to wait for that sound to achieve that unity.

If the problems of C2 between Services are bad, then the challenges faced by coalition C2 is even worse. All of the issues inherent in joint C2 are similar for coalition C2. Instead of talking about Service "culture," a commander may have to deal with truly different cultures from a civilization other than his or her own. Communication, and thus effective C2, is made more difficult by "differences in culture, philosophy, religion, ethnic background, and regional ties."<sup>14</sup> This struggle for unity of effort also must play out against a backdrop of language barriers, mostly incompatible equipment and a more sensitive political environment. While there are no "silver bullets" for solving these problems, Martha Mauer does a great job (See Figure 4) of identifying the important considerations as they relate to the JCS definition of command and control.

***The exercise of authority***

Who defines the limits of authority? Who is the authority?

***and direction***

What and who establishes the correct direction, legally, morally, and militarily?

***by a properly designated commander***

Who properly designates the commander? Will it be a singular or a shared command?

***over assigned forces***

What are the assigned forces? Where do they come from? What is their composition, level of skill, training? What is their equipment like; is it interoperable or compatible?

***of the mission***

What defines the mission? When is the mission over? Who decides the determinant of success?

***Command and control functions are performed ...***

Are procedures, intent, and methods the same or different from each other?

***through an arrangement of personnel,***

How many from each participant? What is their language, ethic, and religious background? Do they have any sensitivities? How well trained are they? What is their style of operation? Are they previous allies or new, temporary partners?

***equipment,***

What and how much equipment is available? What condition is it in? Are supply requirements different? Is it suited for this operation? Is it also in use on the enemy side? Where is it currently located? Is it all compatible?

***communications,***

What languages are involved? What support infrastructure exists or will be provided? Is host support extended equally to all participants? What is the variety of protocols and standards? What variation of capability exists? Is the total capability either interoperable or compatible?

***facilities,***

Where are these located? Any restrictions on their use? What are their capacities or limitations?

***and procedures***

How disparate are procedures? How are common procedures established?

***which are employed by a commander***

What is the command arrangement? How will commands be distributed? Will one commander be acceptable to the United States and to the allies? Who will the commander be?

***in planning,***

Who will do the planning? Will it be a group effort? Who will take the lead? Is there a conflict of planning styles?

***directing,***

How (by what methods and channels) will guidance be distributed? Will all parties accept it?

***coordinating,***

What new channels of communications must be established? Will services be provided across established group lines? Are forces maintaining unit integrity or integrated with each other?

***and controlling forces and operations in the accomplishment of the mission.***

What are the distinctions of operational control and administrative control? Are there any hidden national agendas? What is proof of completing the mission? Who decides? Who goes home first? What accountability measure must be taken?

**Figure 4. Impact of “Coalition” on Command and Control (Source: Martha Mauer, *Coalition Command and Control* [Washington, DC: National Defense University Press, 1994], 16-18)**



## **Interoperability and Joint C2 Systems**

Of all the considerations when building C2 systems, ensuring interoperability between systems is the most important. More than just “functioning without mutual interference,”<sup>15</sup> interoperability involves the capacity of systems to effectively work together to accomplish some function.<sup>16</sup> This factor is vital because future U.S. military operations by definition will be joint and/or coalition operations. Thus the Services cannot afford to have C2 systems that cannot talk with one another. This lesson was learned the hard way during the Gulf War. During that conflict, Navy carriers could not receive (and the Air Force could not send) the Air Tasking Order (ATO) via electronic means. While manual workarounds were developed through physical delivery of the ATO, efficiency and unity of effort were hindered by this shortfall. In part because of this problem, recent DOD directives mandated that “C3I systems for joint and combined operations by U.S. forces must be compatible, interoperable, and integrated, and that *all* C3I systems developed for use by U.S. forces are considered to be for joint use.”<sup>17</sup>

Unfortunately, interoperability is difficult to “add on” after C2 systems are fielded. It is much better to design and build interoperable systems at the beginning of the acquisition process. However, designing and acquiring joint systems presents its own challenges. A case in point is the development of the Joint Tactical Information Distribution System (JTIDS). The program had the word “joint” in its title and had the goal from the beginning of being a joint system. Nevertheless, this primarily Air Force/Navy program was fraught with problems. These were rooted in Service differences, valid technical disagreements, differing operating environment requirements, and fluctuating Service commitment levels.<sup>18</sup> Due to these challenges, a program that

started in the mid-seventies is still undergoing development and procurement in the nineties. While JTIDS has been partially deployed and provides a substantial capability, progress has been slow because “the American military establishment does not naturally create the institutions necessary to evolve the ‘system of systems’ demanded by warfare in the information age.”<sup>19</sup>

Kenneth Allard, in a different section of *Command, Control and the Common Defense*, does a great job of explaining the roots of this challenge in Chapter Seven, “Building Joint Approaches.” He then proceeds to address how this challenge might be met in Chapter Eight, “Historical Linkages and Future Implications.”

### **A Cautionary C2 Tale**

Despite our interoperability challenges, one of the marvelous aspects of the information revolution is the great leap made in the ability of commanders to see the battlefield, know what the enemy is doing, and understand the capabilities of friendly forces. Space surveillance, satellite communications, ubiquitous computers, and advanced software all combine to provide an unprecedented level of information superiority. While this sounds wonderful, there is a real potential for the abuse or misuse of this capability. U.S. Marine Corps doctrine writers, perhaps remembering the echelons of helicopters that hovered over small tactical engagements in Vietnam, have included a cautionary tale in *Marine Corps Doctrinal Publication 6, Command and Control* in the chapter titled “Operation VERBAL IMAGE.”<sup>20</sup> In this story, commanders rely too much on what they see on their computer screens without giving credence to what the people out in the field have to say about actual conditions. An intermediate commander gives orders for actions that seem logical based on maps and common displays, but that don’t have a chance of

working based on the actual terrain. Of course, in the end, Marine Corps ingenuity and initiative save the day. However, the fictional story highlights a very real problem. Our intelligence and C2 technological capabilities provide a great ability and temptation to micromanage. This cautionary tale reminds us that “topsight” is okay, but that micro-managing “oversight” based on what comes out of our advanced C2 systems is not something to take lightly. Commanders at all levels should read this parable to ensure they do not fall prey to this temptation.

## Summary

Implementing C2 processes and C2 systems involves a number of considerations beyond deciding who will exercise the command function. The impacts of organizational structure should be considered. Joint and coalition cultural differences must be assessed. Technology must be harnessed as an enabler of joint C2, not as a degrader due to interoperability and compatibility glitches. Finally, C2 systems must not be abused by expecting more from them than they can deliver in terms of battlefield representations. Relying too heavily on the tools at the expense of the people on the scene can lead to stifled initiative, micro-management, and severe consequences.<sup>21</sup>

## Notes

<sup>1</sup> Sun Tzu, *The Art of War*, 93.

<sup>2</sup> Hughes, “Command and Control within the Framework of a Theory of Combat,” 7.

<sup>3</sup> Snyder, *Command and Control—The Literature and Commentaries*, 44.

<sup>4</sup> *Ibid.*, 42.

<sup>5</sup> Philip S. Kronenberg, “Command and Control as a Theory of Interorganizational Design,” *Defense Analysis*, September 1988, 239.

<sup>6</sup> Dr David S. Alberts and Dr Richard Hayes, *Command Arrangements for Peace Operations* (Washington, DC: National Defense University Press, May 1995). 77.

<sup>7</sup> *Ibid.*, 86-87.

<sup>8</sup> *Ibid.*, 91.

<sup>9</sup> *Ibid.*, 89-91.

## Notes

- <sup>10</sup> Allard, *Command, Control and the Common Defense*, 2-3.
- <sup>11</sup> James Winnefeld and Dana Johnson, *Joint Air Operations, Pursuit of Unity in Command and Control*, (Annapolis, MD: Naval Institute Press, 1993), 11.
- <sup>12</sup> *Ibid.*, 11-12.
- <sup>13</sup> *Ibid.*, 172.
- <sup>14</sup> Martha Mauer, *Coalition Command and Control* (Washington, DC: National Defense University Press, 1994), 55.
- <sup>15</sup> Snyder, *Command and Control—The Literature and Commentaries*, 109.
- <sup>16</sup> Joint Publication 1-02, 224.
- <sup>17</sup> Snyder, *Command and Control—The Literature and Commentaries*, 110.
- <sup>18</sup> Allard, *Command, Control and the Common Defense*, 232.
- <sup>19</sup> *Ibid.*, 243.
- <sup>20</sup> *Marine Corps Doctrinal Publication 6, Command and Control*, 1.
- <sup>21</sup> I. B. Holley, “Command, Control and Technology,” *Defense Analysis*, September 1988, 271.

## Chapter 5

### C2 in Action

*There are no “battle management” magic bullets that will substitute for the ability of on-scene commanders, soldiers, and airmen to make appropriate decisions based on the ebb and flow of events.*

—Richard P. Hallion  
*Military Air Power*

Beyond the definitions, the models, and the implementation considerations lies the art of command and control. Reading about how previous commanders have developed and used their own C2 styles in actual wars is the complement of the theoretical constructs and ideas presented so far. Examined within the context of their particular times, these leaders provide valuable lessons for command and control in a dawning information age.

### C2 Evolution

John Keegan, in *The Mask of Command*, traced the command styles of four famous military leaders—Alexander the Great, Lord Wellington, Ulysses S. Grant, and Adolf Hitler. He examined how these four leaders exercised the command function within the context of their times and societies.<sup>1</sup> These situational contexts shaped how they commanded and determined the type of C2 processes they used. Among these contexts

are the role of technology, organizational structures, relationship to the sovereign, and personal risk.

Obviously, advancing C2 technology made a huge difference. Alexander's "technology" was limited to runners, scouts, his own eyes and the volume of his voice. Wellington, while having use of telescopes, still did much of his commanding personally.<sup>2</sup> More recently, Grant and Hitler used telecommunications capabilities such as the telegraph and radio to speed their C2 processes.<sup>3</sup> In addition to these technology changes were organizational developments. While Alexander could get by with a simple organizational structure, this was not true of later armies. From Wellington on, military staffs took on an important part in war. This began the split of the unitary command function into the current command and control functions. The need for these staffs sprang up in part from the specialization of armies into different functional units and formations that had to be controlled and drilled in more complicated ways.<sup>4</sup>

Another difference between the leaders was the degree to which they embodied the functions of sovereign as well as those of battlefield leader.<sup>5</sup> Alexander is the classic "warrior-king" who combined both functions. Thus, the strategic and operational realms were inseparable in thought and in action. On the other hand, Wellington and Grant fought as representatives of their societies and were beholden to a king and president, if not a parliament and congress. The final element was the extent to which these leaders put themselves at personal risk. Alexander the Great, the archetype heroic leader, took great personal risks on the battlefield and did a good deal of hand-to-hand fighting. While such an approach is inspiring, future leaders (such as the anti-hero Wellington) realized that "a general's station need not be fixed at the point of maximum danger, that he might

indeed serve the cause of victory better from a place where he could observe and encourage others rather than fire others by his example.”<sup>6</sup> Grant, characterized by Keegan as unheroic due to his quiet and undramatic style, continued this evolution towards the rear. He avoided any immediate dangers and preferred to lead near the front lines but not at them.<sup>7</sup> This contrasts sharply with the WW I “chateau generals” and Adolf Hitler. Most WW I generals stayed far to the rear and took little thought to actually visiting the front lines to observe fighting conditions. It was from country estates around 50 miles to the rear that “the great slaughter of the trenches would be directed.”<sup>8</sup> While Hitler, falsely maintaining a heroic image, kept to the rear both physically and mentally as described by Albert Speer in *The Mask of Command*:<sup>9</sup>

The table was elegantly set with silver, glass, china and flowers. As we began our meal, none of us at first saw that a freight train had stopped on the adjacent track. From the cattle car bedraggled, starved and, in some cases, wounded German soldiers, just returning from the east, stared at the diners. With a start Hitler noticed the sombre scene just two yards from his window. Without as much as a gesture of greeting in their direction, he peremptorily ordered the servant to draw the shades. This, in the second half of the war, was how Hitler handled a meeting with ordinary front-line soldiers such as he himself had once been.

In sum, all these contextual elements, combined with these leaders innate personalities, were important in determining the “mask of command” they used. Their individual C2 styles represent fine examples of C2 in action.

## **The Reward**

All of the recommended readings presented so far have been scholarly works of one kind or another. A few are easy to devour, but most require some concentration. So for the officer who has diligently plowed through the previous texts as part of a personal reading program, it is now time for a reward. The final reading is not a dissertation, no

military expert wrote it, and there are no footnotes in it. It is a Pulitzer Prize-winning novel written by Michael Shaara called *The Killer Angels*. Already made into a Hollywood movie, it is a well-written and entertaining read about the battle of Gettysburg.

While not intended as a command and control treatise, it nonetheless provides excellent examples of command and control in action. For instance, take the defense of Little Round Top by Colonel Chamberlain and the Twentieth Regiment of Infantry, Maine Volunteers. During a pause between the successive waves of Confederate attacks, Colonel Chamberlain performs each step in the Lawson-Moose C2 Cycle. First, he *senses* the environment with his own eyes and from the status reports of his officers. Then he *processes* that data into an assessment of his own forces (short of ammunition, badly depleted, no reinforcements) and what the enemy is likely to do (attack again). He then compares the current situation against the desired state—which is to hold the left flank of the Union Army. Based on this, he realizes his work is not done. So he *decides* what to do to influence the war fighting environment to achieve his objectives and conveys his decisions to his troops. Then the entire unit *acts* to implement his decisions and repulse the next attack by fixing bayonets and doing a right wheel forward.<sup>10</sup> This is just but one example from *The Killer Angels*. The entire book, when read with C2 in mind, provides prime illustrations of the C2 operational art in action.

## Summary

As with any war fighting discipline, command and control cannot be mastered solely from theoretical study. Nor can C2 be understood simply as a science that examines only C2 Systems. Looking at how previous commanders actually conducted C2 gives future



practitioners a glimpse into the operational art required for this discipline. Both Keegan and Shaara provide readable and lucid cases of C2 in action.

#### Notes

<sup>1</sup> John Keegan, *The Mask of Command* (New York, NY: Viking Penguin, 1987), 2.

<sup>2</sup> *Ibid.*, 137.

<sup>3</sup> *Ibid.*, 210 and 301.

<sup>4</sup> *Ibid.*, 120-134.

<sup>5</sup> *Ibid.*, 312.

<sup>6</sup> *Ibid.*, 331.

<sup>7</sup> *Ibid.*, 208-210.

<sup>8</sup> *Ibid.*, 333.

<sup>9</sup> *Ibid.*, 308.

<sup>10</sup> Michael Shaara, *The Killer Angels* (New York, NY: Ballantine Books, 1974), 217-250.

## Chapter 6

### Conclusions

*Every art has its rules and maxims. One must study them: theory facilitates practice. The lifetime of one man is not long enough to enable him to acquire perfect knowledge and experience. Theory helps to supplement it, it provides a youth with premature experience and makes him skillful through the mistakes of others.*

—Frederick the Great  
*Military Air Power*

In today's military, few areas are more overlooked than the sometimes difficult subject of C2. While a crucial war fighting topic, it is not always easy to understand—thus many avoid it completely or focus on narrower C2 technical concerns. This paper shed some light on this area by providing a “roadmap” for C2 exploration. It clarified how C2 Systems implement C2 Processes that in turn enable the war fighting C2 Function. Then the paper explained two models—the OODA Loop and the Lawson-Moose Cycle—that further show the interactions between various C2 elements. Next, the paper presented considerations for implementing effective C2. These include challenges of culture, organizational design, joint interoperability, and the dangers of micro-management. Finally, tracing command styles and looking at an example of C2 during the battle of Gettysburg highlighted the art of C2 in action.

More importantly, this paper identified the seminal texts a senior company grade or field grade officer should read to “get smart” on C2. Incorporated into a regular personal

reading program, these books provide a “roadmap” for a professional reading journey that gives a good start to understanding C2. Each of these books is excellent and is worth reading in its entirety. But if one has limited time, the key chapters are shown in Table 1.

**Table 1. Summary of Recommended C2 Readings**

<b>Reading</b>	<b>Author</b>	<b>Specific Chapters</b>
<i>Command and Control, The Literature and Commentaries</i>	Snyder	1, 7, 9
<i>Command in War</i>	Van Creveld	2, 8
<i>Command, Control and the Common Defense</i>	Allard	6 (pages 153-160), 7
<i>Command Arrangements for Peace Operations</i>	Alberts and Hayes	5
<i>Joint Air Operations</i>	Winnefeld and Johnson	2, 9
<i>MCDP 6, Command and Control</i>	USMC	Operation VERBAL IMAGE
<i>The Mask of Command</i>	Keegan	All
<i>The Killer Angels</i>	Shaara	All

In the end, “although the promise of modern command and control stops well short of completely dissipating the fog of war, it has the potential to turn night into day, to achieve spans of control that can be measured in global terms, and to mass collective combat power without massing forces.”<sup>1</sup> *Joint Vision 2010* depends on this type of C2 to underwrite information superiority. In turn, information superiority enables dominant maneuver, precision engagement, focused logistics and full-dimensional protection. Given this string of dependency, war fighters would be wise to learn about the art and science of command and control.

#### Notes

<sup>1</sup> Allard, *Command, Control and the Common Defense*, 270.

## Appendix A

### Finding the Recommended Readings

Most of the readings are available at military base libraries. Several texts may also be bought through commercial vendors. Others must be obtained either through the Government Printing Office or directly from the sponsoring organization. Potential Internet-based sources are:

Commercial Vendors—such as [www.amazon.com](http://www.amazon.com) or [www.borders.com](http://www.borders.com)

Keegan, *The Mask of Command*

Shaara, *The Killer Angels*

Van Creveld, *Command in War*

Winnefeld and Johnson, *Joint Air Operations*

Government Printing Office—[www.gpo.gov](http://www.gpo.gov)

Allard, *Command, Control and the Common Defense*

National Defense University—[www.ndu.edu/inss/press/ndup2.html](http://www.ndu.edu/inss/press/ndup2.html)

Alberts and Hayes, *Command Arrangements for Peace Operations*

Snyder, *Command and Control—The Literature and Commentaries*

United States Marine Corps—[www.doctrine.quantico.usmc.mil/manual.htm](http://www.doctrine.quantico.usmc.mil/manual.htm)

*Marine Corps Doctrinal Publication 6, Command and Control*

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